



Einladung zum Gastvortrag  
im Rahmen des Seminars Chemie und Technologie der  
Materialien von

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Technische Universität Wien

**„Monolithically Integrated Mid-infrared  
Nanosensors“**

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This talk aims to give a short introduction in the field of quantum cascade devices with a strong focus on quantum cascade lasers (QCLs) and quantum cascade detectors (QCDs). A bi-functional QC structure will be presented [1,2], that can be operated in two modes, as coherent light emitter as well as intersubband detector, depending on the bias applied to the structure [3].

This opens the way to on-chip sensing solutions with a high integration density [4]. Liquid sensing at room temperature with a monolithic integrated sensor was achieved by a QCL, a dielectric loaded Surface Plasmon Polariton (SPP) waveguide as interaction section of the infrared light with the liquid, and a QCD.

To demonstrate gas sensing with the same technology a surface emitting and detecting sensor was processed using the very same heterostructure material. A distributed feedback ring quantum cascade laser is integrated on-chip with a detector element. The surface emitted light is collimated, guided through a gas cell, back reflected by a flat mirror, focused, and detected by the sensor element on the very same device. The surface operation mode enables for comparable long interaction lengths as needed for gas absorption measurements [5].

- [1] Schwarz, B. et al., Sensors 13, 2196, 2013 [2] Schwarz, B. et al., Appl. Phys. Lett. 107, 071104, 2015  
[3] Schwarz, B. et al., Nat. Commun. 5, 4085, 2014 [4] Ristanic, D. et al., Appl. Phys. Lett. 106, 041101, 2015  
[5] Harrer, A. et al., Scientific Reports 6, 21795, 2016

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Seminarraum 2 der Fakultät für Chemie  
Währinger Straße 42, 1090 Wien

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